Changes in diastology and atrial function in multimodality imaging after breast cancer radiotherapy - a six-year follow-up study

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Aims: Breast cancer radiotherapy (RT) increases the incidence of heart failure with preserved ejection fraction with long latency. The prevalence and the early phases of this process are not well characterized. The aims of our study were to evaluate changes in diastology and left atrial function after breast cancer RT in a prospective manner.

Methods: 31 patients with early stage left-sided breast cancer were studied prior to RT, immediately after RT and three and six years after RT. Biomarkers were measured and echocardiography, including left atrial strain, was performed at each visit. Cardiac magnetic resonance imaging (CMR) was performed at the six-year follow-up (FU).

Results: At baseline, the median diastology gradus was 1 with 5 patients displaying diastology gradus greater than 2. At six-year follow-up the median diastology gradus had increased to 2 ($p = 0.012$) with 13 patients in diastology gradus 3-4. Additionally, proBNP increased progressively from baseline level of 63 [37, 124] ng/l to post-RT level of 84 [40, 154] ng/l ($p = 0.031$), to 90 [46, 132] ng/l at the three-year follow-up ($p = 0.021$) and to 98 [50, 176] ng/l at the six-year follow-up ($p = 0.010$). Left atrial strain initially increased from 23.2 ± 4.9% at baseline to 25.5 ± 6.7% post-RT ($p = 0.199$) and thereafter decreased to 21.2 ± 6.0% ($p = 0.002$) at six-year follow-up. There was no correlation in left atrial strain between 2D-echocardiography and CMR. Age (mean 62.2 years) had no correlation with changes in diastology or left atrial strain. Furthermore, left atrial strain rate (SR) increased progressively from 2.14 [1.83, 2.50]1/s at baseline to 2.35 [1.95, 2.96]1/s at the three-year follow-up ($p = 0.040$) and thereafter declined to 1.92 [1.62, 2.59]1/s ($p = 0.014$). The change in left atrial SR (from RT to the six-year control) was independently correlated with body mass index (BMI) ($p = 0.044$, $\beta=0.472$). The changes in diastology had no independent predictors.

Conclusions: RT induced a gradual worsening in diastology gradus, which was initially compensated with an increase in left atrial function. However, at the six-year follow-up, 43.7% of the patients had restrictive or pseudonormal diastology and a significant decline in left atrial strain and SR were detected. A lower BMI had a negative influence on the left atrial function.

Abstract Figure. Changes in diastoly during six-year FU